



Son of a gun: military contributions to science

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In 214 BC, a robed man stood on a beach and confronted an army. His weapon: a mirror. Although you might be wondering, in fact, he wasn't eccentric, magical, or mad. His name was Archimedes and he was a scientist.

The "Archimedes heat ray" was an attempt to destroy enemy ships, and involved using a curved mirror to focus waves of sunlight into a single incandescent ray. According to legend, the attacking fleet burst into flames in seconds.

Science has been influencing, aiding, and justifying armed pursuits since classical antiquity, a close relationship which continues today. The Ministry of Defence (MOD) are major patrons of scientific research with an annual R&D budget of £500 million. This investment has driven technological advancement in fields as diverse as nuclear energy and genetics. From duct tape to microwaves, military innovations are thoroughly embedded in modern life but the benefits stretch far beyond civilian convenience. Technological prowess can be decisive in conquest and defeat, shaping empires and the fates of civilisations.

"War is the only proper school for a surgeon"

Hippocrates, c. 460 – 370 BC

The widespread suffering caused by conflict has motivated developments which have had profound effects on medicine. Throughout human history war and disease were synonymous. However, as weapons became more sophisticated and armies grew, war presented new medical challenges. Guns and bombs replaced swords and spears and the power of these weapons was reflected in the injuries they could inflict. Disease presented another major problem. Casualties as a result of pandemics, plagues, and wounds can be critical in determining victory or defeat; during the Crimean War 16,000 of 22,000 British fatalities occurred off the battlefield.

It is this situation that Howard Florey and Ernst Chain had in mind when they began studying a promising new antibiotic at Oxford after the outbreak of WWII. They had extracted a chemical from cultures of the *Penicillium* mould, which they called Penicillin. They set out to purify it and test its effectiveness at treating infection. After successful tests in mice they recruited Albert Alexander, a policeman who had developed sepsis after a scratch from a rose bush. He underwent a dramatic recovery, although tragically there was not enough of the new drug to save him.

Florey realised the significance of his findings to the war effort- a potent antibiotic would be a significant

advantage to the Allied Forces. Impelled by the urgency of the situation, his next focus was production and after further tests the drug entered industrial production. It was a timely breakthrough; thousands of soldiers benefitted and amputation rates fell dramatically.

Another military contribution to the modern medicine cabinet is artemisinin, the standard treatment for malaria caused by *Plasmodium falciparum*, which was discovered as part of an initiative by the Chinese army to decrease the parasite's military victims.

The association between emergency medicine in the military field and trauma care in civilian hospitals represents another shared territory with treatments pioneered on the battlefield regularly adopted by hospitals. This is especially true for head wounds, which are a "signature injury" of the wars in Afghanistan and Iraq and a leading cause of brain trauma in the UK. In the search for an effective drug to improve recovery, battlefield surgeons stumbled on a surprising solution. By administering progesterone, a female sex hormone involved in the menstrual cycle and pregnancy, they

reduced the risk of death and disability in patients with traumatic brain injuries. The treatment is currently being investigated for strokes and neurodegenerative disease.

However, when science is misappropriated, the outcome can be catastrophic. In the hands of Nazi researchers, genetics was transformed into Eugenics and used to rationalise the supremacy of the "Aryan race" and the persecution of the Jews. The recent chemical attacks in Syria and nuclear dispute in Iran are further evidence of the risk that science will be subverted for political means.

Shortly after he was elected as our Prime Minister in 1940, Churchill took it upon himself to formalise the influence of science on political decision making. He created the position "chief scientific advisor" and appointed Frederick Lindemann to provide guidance during the Second World War. It was not a promising start. Lindemann became notorious, famously underestimating the sophistication of German defence technology and advocating "area bombardment"- the indiscriminate bombing of German cities, contributing to an estimated 50 million civilian casualties.

Science and the military are intimately related. Technological advancement is highly strategic and has been used to expedite political agendas and

intimidate enemies for thousands of years. Certainly, the contributions of medicine, physics, and engineering are compelling. British military research has yielded benefits in national security and led to the development of countless modern innovations, including nurses, neuroscience, nuclear physics, surgery, and prosthetics. However, the collaboration has also borne increasingly deadly weapons and ethical challenges. Let's hope for more of the former in the future. In the words of Archimedes "Eureka!"

About the Author

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